NASA/GSFC	NETWORKS AND MISSION SERVICES PROJECTS (N&MSP) CONFIGURATION CHANGE REQUEST (CCR)

1. CCR. NO.	2. DATE	3. PRIORITY	4. CHANGE LEVEL
CCR-451-ICD-14	April 2, 1999	☐ EMERGENCY ☐ URGENT ☒ ROUTINE	☐ A ☒ B ☐ C

5. TITLE OF CHANGE
Updates Reflecting NCC 98 Initial Release Compatibility (Two User One SHO, etc.) And Miscellaneous Clean Up

6. DOCUMENT TITLE : Interface Control Document (ICD) Between the NCC/FDF and the WSC, Revision 5, through DCN 01, 6/30/98

DOCUMENT NO. : 530-ICD-NCC-FDF/WSC, Rev. 5 through DCN 01

LIST ALL AFFECTED DOCUMENTS INCLUDING PROCEDURES 405-TDRS-RP-ICD-001, 12/95 through SCN 01,
530-ICD-NCCDS/MOC, DCN 6, 4/97 ICD Between the NCC and the MOCS
530-SNUG, Rev. 7, 11/95, Space Networks Users Guide
530-RSD-WSC, Rev. 1, 6/1/97, Requirements Specification for the White Sands Complex (WSC)

7. REASON FOR CHANGE To incorporate changes for compatibility with NCC 98.

8. DESCRIPTION OF CHANGE Pages 2-3, 2-8, 2-10, 2-12, 9-4, 9-4a, 9-4b, 9-17, 9-66, 9-96

9. IMPACT

SYSTEM

Y	N		Y	N		Y	N	
☐	☒	SCHEDULE	☐	☒	BUDGET	☐	☒	FACILITIES
☐	☒	TESTING	☐	☒	TRAINING	☐	☒	CONTRACTOR SUPPORT
☒	☐	INTERFACES	☐	☒	SECURITY	☐	☒	HARDWARE
☒	☐	SOFTWARE	☐	☒	LOGISTICS	☒	☐	DOCUMENTATION
☒	☐	GROUND SEGMENT				☐	☒	SPACE SEGMENT
☐	☒	OTHER_____						

ORGANIZATIONAL

Y	N		Y	N		Y	N	
☐	☒	450	☐	☒	____	☐	☒	MSFC
☒	☐	451	☐	☒	____	☐	☒	JSC
☐	☒	452	☐	☒	____	☐	☒	LERC
☐	☒	453	☒	☐	Code 405	☐	☒	KSC
						☐	☒	JPL

10. COMMENTS
URL http://stelwspo.gsfc.nasa.gov/icd/530-NCC/

11. ORIGINATOR D. Gilliland 301-809-2205 **CODE** 451

SIGNATURE_____ **DATE**_____

12. SEGMENT MANAGER'S APPROVAL **CODE** _____

SIGNATURE _____ **DATE** _____

13. BOARD CHAIRPERSON SIGNATURE **DATE**

14. BOARD CHAIRPERSON COMMENTS

15. BOARD ACTION
☐ Approved ☐ Withdrawn
☐ Disapproved ☐ Deferred
_____

16. ACTION REQUIRED
☐ Publish Document ☐ Publish DCN
☐ Deviation ☐ Waiver
☐ Implement Change ☐ Other _____

The state vector types that will be processed at WSC are as follows:

Vector Type	Application	Phase
1	Free-flight (On-Orbit)	Free-flight state vectors
2	Transition to free-flight	A type 2 vector is used only as the transition vector from maneuver sequence vectors to free-flight vectors
3		Not used
4	Ignition	First vector in maneuver sequence
5	Burnout	Last vector in maneuver sequence
6	Reentry	Landing maneuver sequence vectors
7	Launch or on-orbit	Launch or on-orbit maneuver sequence vectors
8	Stationary	Stationary state vectors

The following general ground rules apply:

1. Except for permanent Earth stations, user trajectory data is used according to receipt time. For each user, the most recently received vector, regardless of type, will be used from its epoch time forward. Previously received vectors with later epochs will not be used following receipt of a new vector with an equal or earlier epoch.
2. Free-flight (type 1-2) vectors will be rejected by WSC if they fail syntax, check sums, or if (1) the magnitude of the position vector is less than 6356 kilometers or (2) the epoch time of the vector is more than 12 hours earlier than the time of receipt at WSC. If a free-flight vector is rejected for any of the above reasons, a state vector reject message will be sent to the NCC.
3. Except for permanent Earth stations, no stationary state vector will be propagated more than 24 hours from its epoch time. No free-flight state vector will be propagated more than 12 hours from its epoch time.
4. A state vector OPM for a permanent Earth station should contain a single state vector, wheras other state vector OPMs may contain up to three state vectors~~A single state vector OPM may contain up to three state vectors~~. When three or more state vectors for a single user are to be transmitted, the NCC shall include three state vectors in each state vector OPM until fewer than three state vectors remain. When fewer than three state vectors for a single user are to be transmitted, these state vectors shall be transmitted in a single state vector OPM. All state vector OPMs shall be transmitted with the acknowledgment request flag set.
5. OPM Classes 61, 64 and 65 will be sent to the NCC without TDRSS Operations and Control Center (TOCC) operator intervention.
6. The formats for free-flight (types 1-2), maneuver sequence (types 4-7), and stationary (type 8) state vector OPM's are identical. The vector types indicate whether an OPM contains free-flight, maneuver sequence, or stationary state vectors.

9. Schedule conflicts will result in the discard of the later received SHO which caused the conflict and the generation of a conflict message (OPM) which will be sent to the NCC. All previously planned and currently ongoing services will continue.

10. Back-to-back (or overlapping) user support periods may be scheduled ~~by separate SHO's~~ on different links~~.~~, however a ~~A~~ minimum of ~~15~~ 20 seconds is required between ~~Shuttle~~ SHOs ~~scheduled at~~ which require use of the same ground ~~terminal (Danzante or Cacique) is required for service support.~~resource (e.g. Logical Port Address, Shuttle Unique Equipment, etc).

11. When requested in the SHO, return link time delay data will be provided on the equipment configuration in use at the start and conclusion of service, when the equipment configuration changes and at reconfigurations during the service period. These return link time delay data will be sent after service termination. The Return Channel Time Delay (RCTD) measurement is valid for DIS MDM return services with symbol rates $\leq$ 6 Msps for NRZ data (3 Msps for biphase) per I or Q channel.

12. All services in the SHO must cover a contiguous time period. During the time interval from the earliest service start time to the latest service stop time in the SHO, there must not be any period for which no service is being provided to the user. Within a SHO, the minimum time between the stop time of a service and the start time of the same service shall be 15 seconds. MA Return (MAR) Channel availability is based on the assumption that a MAR Channel is allocated to a SHO from the earliest MAR service start time to the latest MAR service stop time in the SHO. Overlapping of MAR services in a SHO shall be rejected by the WSC. This ground rule applies to SMAR also.

13. All services in the SHO must be for the same TDRS. With the exception of S-band Single Access (SSA) combining, all services in the SHO shall be for the same TDRS SA antenna.

14. For tracking services, the related forward and/or return services must be scheduled for the entire duration of the tracking service and must be described in the same SHO. Simultaneous SSA and Ku-band Single Access (KSA) services from the same SA antenna must be described in the same SHO.

15. For optimal performance, all coherent services (i.e., Data Group 1 (DG-1) Modes 1 and 3 and all coherent carrier services) should have the forward and return services starting at the same time. If operational considerations require starting the forward service before the return service, no reconfigurations of the forward service (i.e., OPMs 02, 03, and 11) shall be sent within 30 seconds of the start of return service. OPM 04 shall not be sent within 150 seconds of the start of the return service. These messages will not be rejected, but could cause inaccuracies in subsequently scheduled tracking data.

16. For a User Reconfiguration Request OPM, the reconfigurable parameters shall be contained in the Reconfiguration OPM. The SHO contains the initial configuration (the fixed parameters plus the initial group of reconfigurable parameters for that service).

17. Deleted.

18. Deleted.

19. All SHO's (periodic and routine) shall have the same format.

with the Vehicle Identification Code (VIC) are used to identify the User and, in turn, to correlate SHO's with the User spacecraft state vector.

31. Definition of Effective Isotropic Radiated Power (EIRP) - The user spacecraft minimum and maximum EIRP (paragraphs 9.2.3.8, 9.2.3.10, 9.2.3.12) over the scheduled service period are defined as follows:

$$EIRP(t) = EIRP_u(t) - 20 \log \frac{R_{u(t)}}{R_{spec}} + n \text{ dBW}$$

where:

EIRP(t)	is the User's apparent EIRP, assuming the User spacecraft is located at a range R_{spec} from TDRS.
$EIRP_u(t)$	is the time User's actual EIRP based on the User's transmitter power, antenna gain, efficiency, and pointing losses.
$R_u(t)$	is the time varying range of the user spacecraft from TDRS.
R_{spec}	is the range of the user spacecraft from TDRS corresponding to a propagation space path loss of -192.2 dB for S-band and -209.2 dB for K-band.
n	is a factor which accounts for antenna polarization loss due to imperfect circular polarization of the User spacecraft transmit antenna.

Hence, $EIRP_{max}$ is the maximum value of EIRP(t) and $EIRP_{min}$ is the minimum value of EIRP(t) over the scheduled service period. WSC shall use the minimum EIRP value, in conjunction with TDRS performance parameters, to compute a C/N_o for configuring the IR. Maximum Data Rate values shall be provided in the SHO. For User End-to-End Test Services, the "EIRP of Simulated User" (paragraph 9.2.3.15) is EIRP(t) at the return End-to-End Test service start time.

32. For a User transmitting DG1 data from a single source by Quadrature Phase Shift Keying (QPSK) modulation, the SHO data rate for the I and Q channels should be set to the same value - that which is the data rate of the user single source. However, if either I or Q modulator of the user is inoperative, then that corresponding I or Q channel data rate should be set to a value of zero in the SHO. For DG2, the I and Q Channel data rates shall be one-half the single source data rate, except as specified in Ground Rule 42.

33. For a user transmitting data by Binary Phase Shift Keying (BPSK) modulation, the SHO data should be as follows:

DG1 -	I Channel only:	Specify I channel data rate only; set Q Channel data rate to American Standard Code for Information Interchange (ASCII) space.
DG1 -	Q Channel only:	Specify Q channel data rate only; set I channel data rate to ASCII space.
DG2:		Specify I channel data rate; set Q channel data rate to ASCII space.

42. For users transmitting from a single source by QPSK modulation, only the I Channel data of Subheader 6 is applicable and shall indicate the single source data rate. ~~For users transmitting BPSK, the applicable channel of Subheader 6 is as specified in Ground Rule 33.~~

43. MA services are applicable for TDRS A-G only. SSA and KSA services are applicable for TDRS A-J. SMA and KaSA services are applicable for TDRS H-J only. Incorrectly scheduled services for a TDRS shall be rejected.

44. Simultaneous scheduling of Ku and Ka Band services on the same SA antenna is not permitted.

45. Ka-Band services are DG-2, noncoherent only. There are no tracking services at Ka-Band.

46. IFL SHOs shall be applicable for Cacique only and shall not be reconfigurable. The number of services in an IFL SHO is always 1. Each service in a normal or EET SHO that specifies potential use of the Danzante HDRM will result in an IFL SHO being scheduled at Cacique. The number of data channels which may be accounted for in the IFL SHO's Subheader 6 is always 2. For Shuttle KSAR, channel 1 is always omitted.

47. The recording (Line Outage Recording (LOR) and Record Only services) of all GRGT supported user services will be performed at Cacique.

48. GRGT will not support Shuttle Analog Data (Shuttle Mode 2, Channel 3 Analog) services.

49. GRGT will have two schedulable MA Return Links, but has the capability to be increased to five.

50. The NCC is responsible for ensuring that the common carrier (Danzante/Cacique-to-GSFC and GRGT-to-Cacique) composite forward and return data rates available for scheduling of user services is not exceeded.

2.2.3 End-To-End Test (EET) Data Ground Rules

The following ground rules apply to End-to-End Test SHO's:

1. Deleted.

2. End-to-End Test services cannot be scheduled alone, i.e., the related traffic services must be included in the SHO.

3. In an End-to-End Test SHO, the start time specified in an End-to-End Test data set must be the same as that of the related traffic service and the stop time in the End-to-End Test data set must be the same as that of the related traffic service.

4. End-to-End Test services cannot be included in a normal SHO. An End-to-End Test SHO must be used for End-to-End Test services.

5. All End-to-End Test SHO reject messages shall be sent to the NCC without operator intervention.

9.2.1 SHO Header

The structure of the SHO header is:

Byte #	# of Bytes	Data Item
23-24	2	Message Type 1 = Tracking Data => 2 = SHO - Routine 3 = OPM (Operations) 4 = SLR (TDRSS Service Level Status) 5 = ODM (SA/SMAR Operations Data) 6 = ODM (MA/SMAF Operations Data) 7 = ODM (End-to-End Test Data) => 8 = SHO - Periodic
25-31	7	SHO ID SHO's shall be sequentially numbered: 1 to 9,999,999 to 1
32-33	2	SHO Class 1 = Normal 2 = Spare 3 = End-to-End Test 4 = Spare 5 = Spare 6 = High Data Rate Multiplexer (HDRM) from IFL (see subheader No. 6)
34-40	7	SUPIDEN - Code assigned by NASA - normal/Shuttle/Virtual user
41-42	2	Vehicle Identification Code (VIC) - Code assigned by NASA - normal/Shuttle/Virtual user
43-49	7	SUPIDEN - Code assigned by NASA - normal/Shuttle/Virtual user
50-51	2	Vehicle Identification Code (VIC) - Code assigned by NASA - normal/Shuttle/Virtual user
52-53	2	User Code Assignment - S-Band This subfield contains the S-Band code assigned ~~for a user~~ (STDN 108)*
54-55	2	User Code Assignment - K-Band This subfield contains the K-Band code assigned ~~for a user~~ (STDN 108)*
56	1	Copy of Byte 53 ~~This subfield contains the code assigned for a user (STDN 108)~~

* For Shuttle the least significant byte of the S-Band User Code Assignment applies. For Normal users, the S-Band User code and the K-band User code will have the same value.

Byte #	# of Bytes	Data Item
57	1	SHO Source 0 = NCC 1 = WSC

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# of Bytes	Data Item
1	Doppler Compensation Required, Normal User 0 = No 1 = Yes
1	Doppler Compensation Required, Shuttle 0 = No 1 = Yes
122	

9.2.3.7 MA Return, Fixed Parameters

# of Bytes	Data Item
3	SHO Subheader 1
22	SHO Subheader 2
1	Receiver Configuration 0 = Normal 1 = Cross-support
1	Symbol Format Conversion to BIϕ-L - I Channel 0 = No 1 = Yes
1	Symbol Format Conversion to BIϕ-L - Q Channel 0 = No 1 = Yes
6	Spare
2	MA Return Link ID (01-05)
1	Spare
1	Cross Support Forward Link ~~0 = MA~~ 1 = SSA1 2 = SSA2
1	Configuration 0 = I Channel only 1 = Q Channel only 2 = I and Q Channel
1	Return Channel Time Delay Data Required 0 = No 1 = Yes
	Max Data Rate (LSD = 1 bps)

9.4.1.1 SLR

The SLR Message shall use the following format:

(Byte #s)	(# of Bytes)	Data Item		
		SGLT 1 Service Chains		
44-45	2	SSA1F	N,C/0,1,2	2 = P&R
46-47	2	SSA1R	N,C/0,1,2	1 = P only
48-49	2	KSA1F/KaSA1F	N,C/0,1,2	0 = Unavailable
50-51	2	KSA1R/KaSA1R	N,C/0,1,2	N = No Change
52-53	2	Spare		C = Change
54-55	2	Spare		
56-67	2/service	(Repeat for SA2)	N,C/0,1,2	
68-69	2	MAF/SMAF	N,C/0,1,2	
70-72	3	MAR/SMAR	N,C/00-~~05~~06	Number of MA/SMA return services chains available.
73-74	2	End-to-End Test	N,C/0,1	End-To-End Test is for all services except Ka. 1 = Available
		Computer Subsystems		
75-76	2	TT&C	N,C/0,1,2	USS1, USS2 or
77-78	2	USS1	N,C/0,1,2	MA=0 implies
79-80	2	USS2	N,C/0,1,2	no services
81-82	2	MA/SMA	N,C/0,1,2	available for
83-84	2	EXEC	N,C/0,1,2	SSA1/KSA1/KaSA1,
85-86	2	LAN(CDCN)	N,C/0,1	SSA2/KSA2/KaSA2 or MA/SMA. TT&C, Executive (EXEC) or LAN = 0 implies no services available for this SGLT.

9.5.5.2 MA Return

# of Bytes	Data Item
1	Service Support Type 0 = Forward 1 = Return
7	Support Identifier Code (SUPIDEN) Section 11.
2	Vehicle Identification Code (VIC)
38	SA/MA/SMA ODM Subheader No. 8
2	MA Return Link ID (1-5) (obtained from SHO)
1	Data Validity 0 = Data Valid 1 = Data Invalid
5	Spare
	RF Beam Pointing: (Defined in Section 9.5)
4	Azimuth ($\pm 90^{\circ}$) Sign, 3 Digits (LSD = 0.1°)
4	Elevation ($\pm 90^{\circ}$) Sign, 3 Digits (LSD = 0.1°)
2	MA Return Link ID (1-6) (ID of the MAR equipment string, including receiver.)
1	Doppler Tracking Status 0 = Inactive 1 = One-way 2 = Two-way 3 = Cross Support
1	Range Tracking Status 0 = Inactive 1 = Active 2 = Cross Support